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## (54) Packaging machine

(57) An apparatus for packaging articles such as fruit and vegetables into net bags comprises a pivotal delivery tube (10) down which the articles are delivered and over which compressed tubular packaging material (22) is stored. A clip sealing head (12) having a sealing slot (18) is disposed below the delivery tube (10). The articles fall into the already-sealed end of the packaging material hanging below the mouth of the tube, and the material is drawn into the slot (18) for sealing and cutting by moving the end of the tube to and fro over the slot, articles being delivered at each end position of movement of the tube (10). An extendible collar (35) on the tube acts to tension the packaging web about the articles.

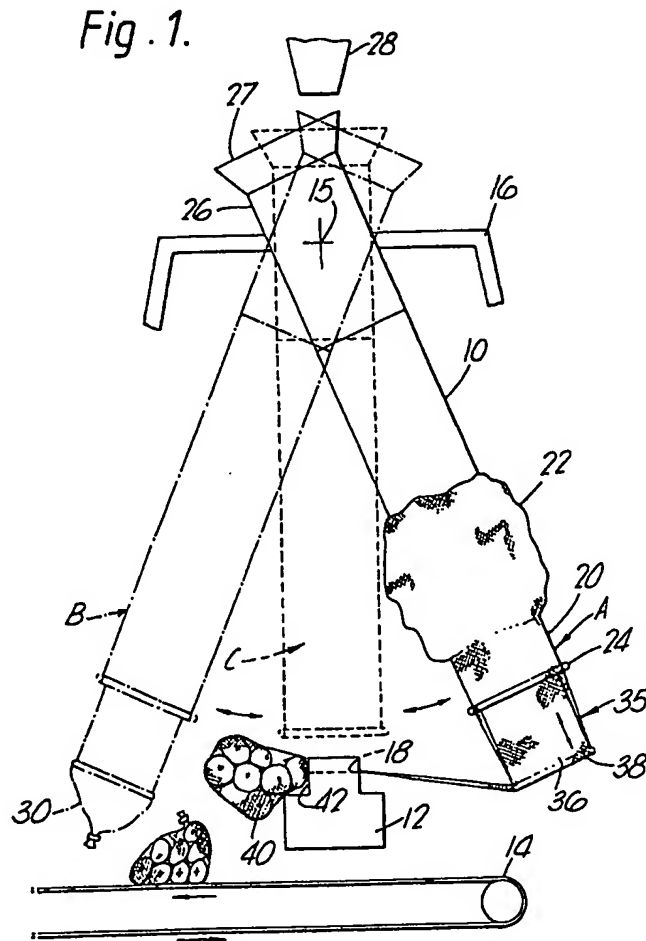
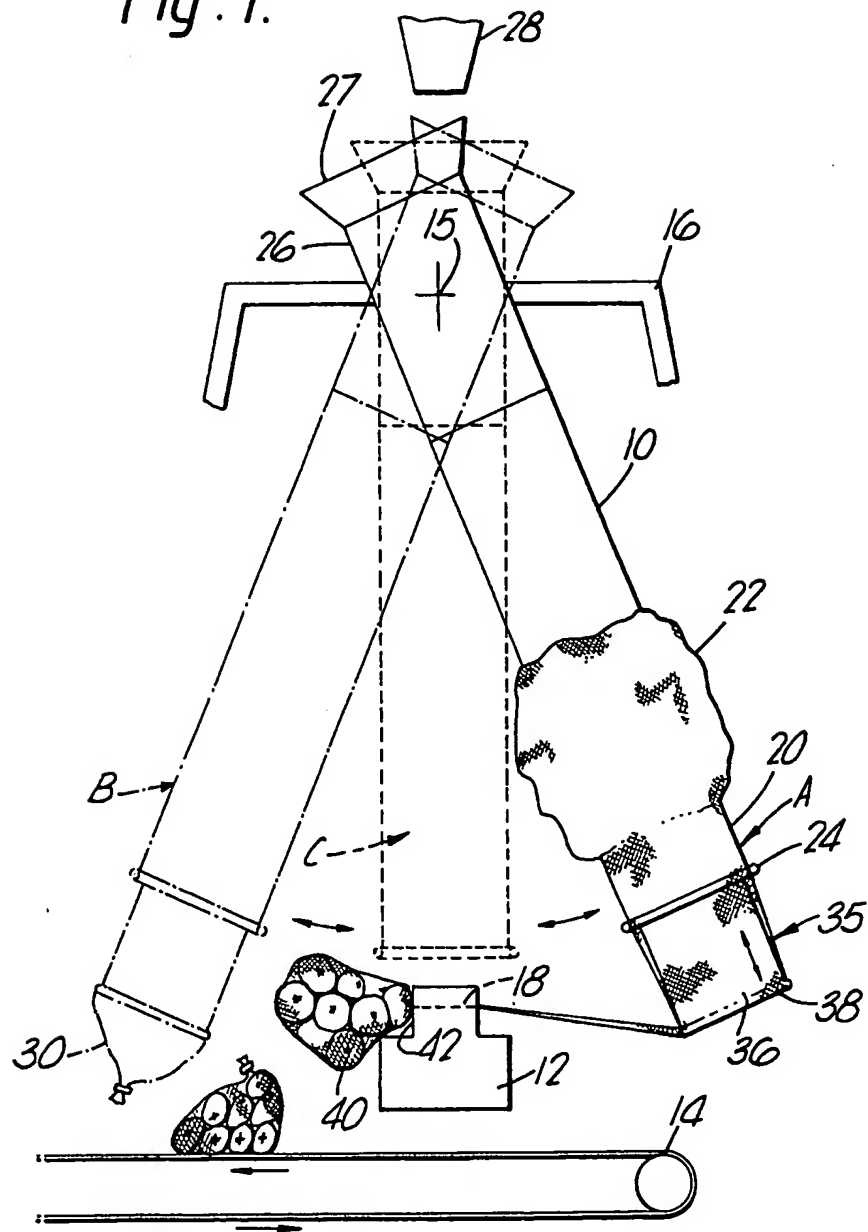


Fig. 1.



*Fig. 2.*

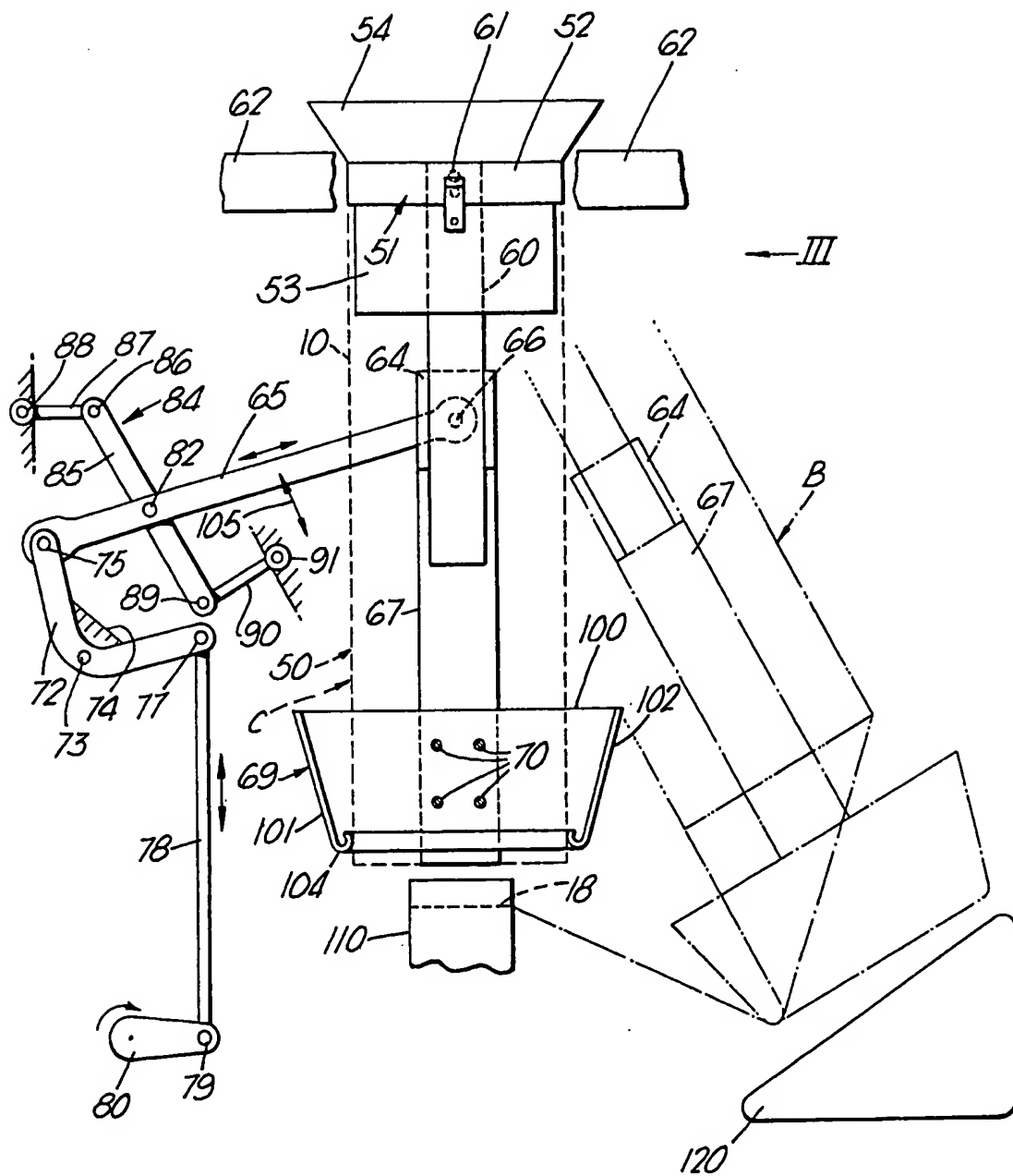
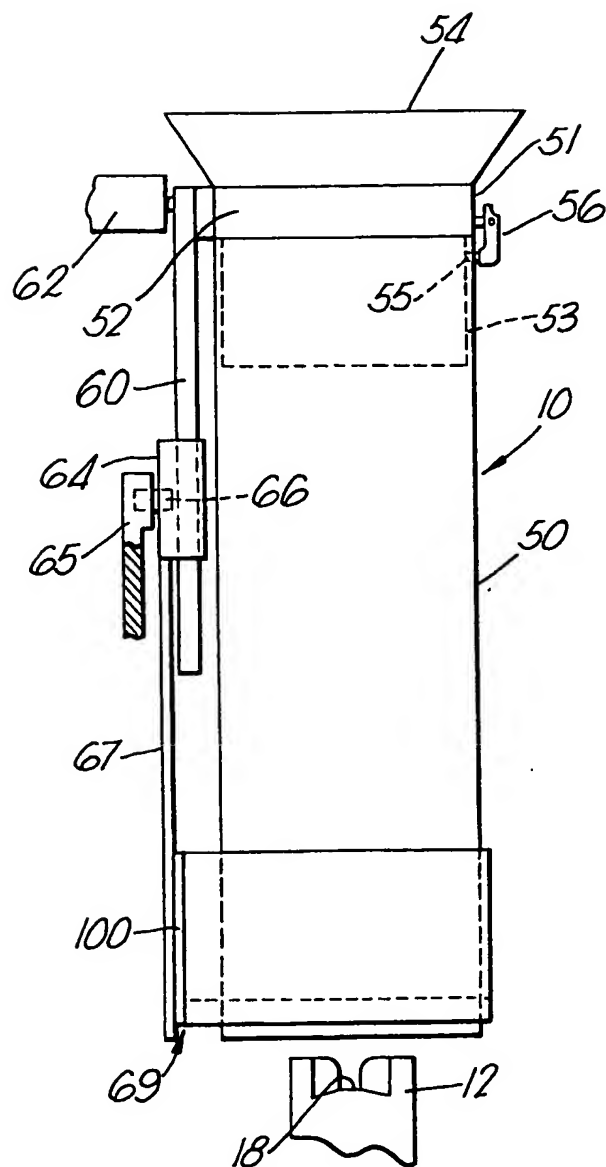


Fig. 3.



## SPECIFICATION

## Packaging machine

5 This invention relates to devices for automatically packaging articles such as fruit and vegetables into tubular packaging material.

Commodities such as fruit and vegetables are frequently sold by retailers pre-packed into tubular packaging material. This material is generally in the form of netting, but sheet plastics and other materials are sometimes used.

10 In a packaging operation using netting material, the commodity is generally delivered in batches from a counting or filling machine through a delivery tube on which a compressed length of the tubular netting is stored, sufficient net to enclose the commodity hanging below the mouth of the delivery tube. The batch of the commodity drops from the mouth of the delivery tube into the already-sealed end of the netting material, and a length of netting material between the end containing the commodity and the end of the delivery tube is gathered into a rope. On forming the rope, the netting is pulled tightly over the goods to form a bag, and the rope is then introduced into the sealing aperture of a mechanical clip-sealing machine at a point as close as possible to the bag. As the rope is introduced into the aperture, the sealing mechanism is operated and two spaced metal clip seals are applied to the rope in the aperture, and the rope severed between the two metal clips. In this way, one of the clips seals the end of the bag in which the commodity is contained, and the other seals the free end of the remaining stored net ready to receive the next batch of fruit or vegetables.

If required, the clip-sealing machine may simultaneously apply a label or tag to the bag and some machines incorporate printers adapted to apply print markings to this label.

The severed bag containing the commodity drops onto a conveyor belt for removal to a packing station.

45 The forming of the bag around the articles, and the introduction of the rope of netting material into the sealing aperture of the clip-sealing machine may be carried out either by hand, or automatically by machine. A machine for carrying out such a packing operation is described and claimed in British Patent No. 1564397.

In this apparatus, the articles are delivered through the delivery tube into the sealed end of the tubular packaging material where they are held suspended below the mouth of the tube. A movable clip-sealing head is then driven into the path of the packaging material between the mouth of the tube and the articles, gathering the material into a rope so that it passes into the sealing aperture, where it is sealed and cut.

The use of a movable sealing head does have certain disadvantages, particularly where labels need to be affixed to the pack at the sealing point.

The present invention provides a fully automatic machine for packaging articles into tubular packag-

ing material in which the sealing head is kept stationary and the delivery tube itself is moved in order to introduce the packaging material into the sealing aperture.

70 According to the present invention, there is provided apparatus for packaging articles into tubular packaging material, comprising a downwardly-directed delivery tube over which the packaging material can be stored and down which, in use, the articles are delivered into the already-sealed end of the packaging material; and a sealing device having a sealing aperture located below the free end of the delivery tube, said sealing device being operable to seal gathered tubular packaging material which has been introduced into the sealing aperture; characterised in that means are provided for moving at least the free end of the delivery tube so as to draw packaging material suspended below the end of the tube into the sealing aperture to be sealed therein.

85 Preferably, the delivery tube is oscillated to and fro above the sealing aperture. The sealing aperture is advantageously a slot comprising a pair of opposed sealing jaws, the slot being aligned in the same plane as the plane of movement of the delivery tube.

90 Thus, instead of the sealing head being moved as in the prior art, according to the invention the sealing head remains stationary and the delivery tube itself is reciprocated to and fro above the sealing head. This greatly simplifies operation and construction of the sealing head, particularly where labelling and printing mechanisms are incorporated.

100 Advantageously the sealing device is operable to apply a pair of spaced seals to the packaging material, and to sever the material between the spaced seals, and apparatus preferably includes control means operable to control the delivery of articles to the already-sealed end of the packaging material to coincide substantially with an end position of the reciprocating motion of the delivery tube at one side thereof. In this way, articles are delivered into the already-sealed end of the packaging material at one end position, and movement of the delivery tube is then used to draw the packaging material disposed between the end of the tube and the articles into the sealing aperture for sealing and cutting purposes. This arrangement has substantial advantages in that, in a preferred embodiment of the invention, the sealing head is located at the mid-point of movement of the delivery tube and articles are delivered into the end of the packaging material at two delivery points, one located at each end position of the delivery tube. The return movement of the tube across the sealing head on each stroke of the tube provides for cutting and sealing of the pack ready for the next delivery at the opposite end of travel. This effectively doubles the operational speed of the machine.

125 In order to provide the desirable tight package for the articles, tensioning means are advantageously provided operable to stretch the packaging material over the articles in the pack prior to the

sealing and cutting operation. This can be achieved by increasing the stroke of the delivery tube such that once the packaging material has been gathered into the sealing aperture, the articles are drawn up against the end face of the sealing device containing the aperture; further movement of the delivery tube then tensions the pack. As in conventional machines, this tensioning operation may be used to dispense the next length of packaging material from its store on the delivery tube.

In order to reduce the stroke of the tube, separate tensioning means are advantageously provided for carrying out this tensioning operation independently of the reciprocating motion of the delivery tube. Suitably these tensioning means comprise a tensioning collar, which may be circular or semicircular and which may surround the tube or be disposed within the tube, which is slidably mounted relative to the delivery tube and which acts to extend the effective length of the tube at its end positions. The tensioning collar is retracted as the delivery tube passes over the sealing head. The advantage of this arrangement is that the downward movement of the tensioning collar as the tube approaches its end positions pulls the gathered packaging material downwardly into the sealing aperture, thus retaining it in an optimum position for subsequent sealing and cutting.

Preferably the delivery tube is pivotally mounted for reciprocal movement about a point disposed vertically above the sealing aperture, and the tube is substantially vertical in its central position.

In order that the invention may be more fully understood, embodiments in accordance therewith will now be described by way of example with reference to the accompany drawings, in which

*Figure 1* is a diagrammatic front view of apparatus for packaging articles into tubular packaging material;

*Figure 2* is a diagrammatic rear view of another embodiment of apparatus for packaging articles into tubular packaging material, the drawing having parts cut away to illustrate the operation of the mechanical linkage; and

*Figure 3* is a side elevation of the apparatus of *Figure 2*, looking in the direction of arrow III, with some parts omitted for clarity.

Referring to the drawings, *Figure 1* shows an apparatus for packaging articles into tubular packaging material.

The main components of the apparatus comprise a delivery tube 10, a sealing device 12, and a conveyor 14. The delivery tube 10 is mounted for pivotal swinging movement about a horizontal axis 15, which comprises a pin supported in frame 16. The delivery tube 10 is operable to oscillate between right-hand end position A shown in unbroken lines in *Figure 1* and left-hand end position B shown in chain-dotted lines in *Figure 1*. The swinging movement of tube 10 between these limit positions is controlled by a pneumatic cylinder and piston assembly (not shown).

The sealing device 12 is disposed directly beneath pivot axis 15, and has a sealing aperture 18 comprising a vertically-disposed slot aligned in the

plane of movement of delivery tube 10 such that the centre of the delivery tube will pass directly over the slot 18 at the mid-point C (shown in dotted lines).

The device 12 is a clip-sealing head of conventional construction, incorporating comprising opposed sealing jaws in the form of a pair of anvils (between which is disposed a cutting blade) and a hammer, together with the appropriate drive means for the metal tapes or wires from which the metal clip-seals are formed. When a gathered length of packaging material is present in slot 18, and the clip-sealing mechanism is operated, a pair of spaced clip seals are applied to the rope of material in the aperture, and the material is then severed between the spaced clips.

The tubular packaging material 20 in this case comprises a net material made from a plastic such as polyethylene and this is stored on delivery tube 10 by slipping the material over the end of the tube and then compressing it into a concertina form as shown at 22. Netting material 20 is drawn off the end of delivery tube 10 through a friction collar 24 which may be adjustable to control the pull required to dispense netting material from its store 22.

Batches of the articles to be packaged are delivered into the upper end 26 of delivery tube 10, which is provided with a funnel 27 to facilitate entry to the tube. The batches of articles are delivered from a suitable batching, weighing or counting machine 28 at timed intervals determined by the angular position of delivery tube 10 about its pivot 15.

Tube 10 is provided with a tensioning device 35 which in this embodiment comprises tubular collar 36 slidably mounted within the lower end of delivery tube 10. Sliding movement of collar 36 is operated by a pneumatic piston and cylinder assembly (not shown) and is controlled such that at the two limit positions A and B of delivery tube 10 the collar 36 is extended well beyond the lower end of tube 10. The collar 36 is retractable to a point at which it is wholly or substantially enclosed within tube 10 during the return stroke of tube 10, the collar 36 being fully retracted when the tube reaches its mid-position C. Beyond mid-position C, collar 36 is again extended into its position shown in chain-dotted lines on the left of the drawing.

The apparatus operates as follows. Starting from limit position B in the drawing, and assuming that sealing and cutting has just taken place, a batch of articles is delivered from the weighing, counting or batching machine 28 down delivery tube 10 into the already-sealed end 30 of the tubular packaging material 20. The delivery tube 10 is now moving away from its limit position B towards the sealing device 12, and as it does so collar 36 retracts into the end of the tube. During this movement the articles remain suspended in the packaging material below the end of the tube, and as the tube passes the sealing device 12, the length of material between the articles and the end of the delivery tube is drawn into the clip-sealing aperture 18. A shaped entrance to aperture 18 assists in this; for

example the edges of the aperture may diverge both vertically and horizontally to provide an easy entry for the gathered length of material.

As the tube 10 passes over the sealing device 12, the tensioning collar 36 begins its extension until at limit position A the collar is fully extended as shown in Figure 1. Before tube 10 reaches limit position A, the articles 40 in end 30 of the packaging material are drawn up against face 42 of sealing device 12; at this point, further movement of delivery tube 10 towards limit position A and further extension of collar 36 out of tube 10 tensions the packaging material 20 so that the material is stretched tightly over the articles, as shown on the right in Figure 1. When the tension in the packaging material reaches a pre-determined level, more packaging material 20 is drawn off tube 10 from its store 22 through friction collar 24, the required tension in the pack and the length of material drawn off from store 22 being pre-determined by the throw of tube 10 and tensioning collar 36. The tensioning collar is provided with a rounded rim 38 to avoid damage to the net.

At a point at or close to limit position A, sealing device 12 is operated to apply two spaced seals to the packaging material in the sealing aperture 18, and to sever the material between the seals so that pack 30 is separated from the remainder of the material. The pack 30 falls on to conveyor 14 and a fresh batch of articles is delivered into the free end of the material ready for return movement of tube 10.

It will be appreciated that the various operations of delivery of articles, oscillation of tube 10 and operation of tensioning device 35 and sealing device 12 are all carried out in timed relation, appropriate sensors being provided at various points to achieve this.

Although the apparatus could operate with delivery of articles occurring at only one limit position, e.g. position B, with no articles being delivered at position A but the machine simply returning to position B for the following delivery, the use of two delivery points one on either side of the sealing device 12 effectively doubles the capacity of the machine and results in the apparatus operating at extremely high speed.

Figures 2 and 3 show another embodiment of packaging machine which works on substantially the same principal as that of the machine shown in Figure 1, but which utilizes a mechanical linkage for effecting the movement of the delivery tube and tensioning device.

Referring to Figure 2 and 3, in this case the delivery tube 10 is formed in two parts, namely a detachable lower part 50 and an upper fixed part 51 comprising a collar 52 having a lower part 53 of reduced diameter, and an upper funnel 54. The detachable lower part 50 of the delivery tube is secured to the fixed part 52 by sliding the part 50 over the part 53 of reduced diameter and engaging the nose 55 of spring clip 56 mounted on collar 52 into a corresponding aperture formed in part 50.

The detachable nature of the main portion of the delivery tube 10 means that tube sections 50 with

stored net already mounted thereon, can be kept ready to facilitate rapid reloading when the packaging material is exhausted.

Collar 52 is secured to a main swing arm 60 which is pivotally mounted on axis 61 fixed in frame 62. This provides the main pivotal support for the delivery tube 10, and as shown in Figure 2 swing arm 60 is movable between the limit positions in exactly the same manner as the apparatus shown in Figure 1, only one limit position B being shown in Figure 2 for clarity.

Swing arm 60 carries a slide member 64 freely movable over the length of arm 60 under the action of control arm 65 pivotally connected at 66 to slide 64. Slide 64 also carries member 67 which acts as a support for a tensioning device 69 fixed to free end of member 67 by screws 70.

Control arm 65 controls both the pivotal movement of support arm 60 and hence delivery tube 10, and the extension and retraction of tensioning device 69.

The drive linkage for arm 65 is omitted from Figure 3 for clarity, but is shown in detail in Figure 2, and comprises a crank arm 72 pivotally mounted at 73 to fixed frame member 74, and pivotally connected at 75 to control arm 65. The other end of crank arm 72 is pivotally connected at 77 to drive rod 78, in turn connected at 79 to crank 80. Crank 80 is driven in rotation by drive motor (not shown).

Control arm 65 is floatingly connected at pivot point 82 to a Watts linkage generally indicated at 84 comprising main link 85 pivotally connected at 86 to control link 87 in turn pivotally mounted at 88 to a fixed frame member. The other free end of main link 85 is pivotally connected at 89 to link 90 connected to a fixed frame member at 91. The Watts linkage 84 provides increased throw for control arm 65.

The tensioning device 69 comprises a U-shaped member having a rear wall 100 secured to member 67, and end walls 101 and 102 the lower edges of which are provided with radiused edges 104 to avoid damage to the packaging material during tensioning. In this case the tensioning device is disposed on the outside of tube 10 rather than inside the tube as in the Figure 1 embodiment.

In operation, drive is provided to the mechanism by rotation of crank 80, which causes drive rod 78 to oscillate crank arm 72 about its pivot 73. This in turn causes reciprocation of control arm 65 both axially and in the directions of arrows 105, causing the slider 64 to travel up and down support arm 60 and to oscillate support arm 60 about its axis 61. As shown in Figure 2, the extreme position of slide 64 on support arm 60 substantially coincides with the limit position of the delivery tube 10 supported on the arm. The motion is exactly as described in relation to the mechanism of Figure 1, the reciprocating movement of tube 50 and the extension of the tensioning device 69 operating to draw the pack of articles up against the end face of sealing device 110, to tension the pack, and then to draw off fresh material from the store on section 50 of the delivery tube. It will be appreciated that the length of packaging material between the clipping

head and the radiused edge 104 of tensioning device 69, combined with the throw of the tensioning device 69, is substantially equal to the amount of packaging material required for the next pack.

- 5 As with the Figure 1 embodiment, the machine is timed to operate in accordance with delivery of batched articles into the funnel 54 of delivery tube 50. Operation of the packing cycle is initiated by a sensing device in the path of articles from the weighing or batching machine to funnel 54. Once an appropriate signal has been provided to the drive mechanism, this operates to reciprocate tube 10 about its pivot 61. The machine may also be adapted to send a signal to the batching machine to indicate when the end of tube 50 has passed sealing head 110 and is ready to receive the next batch of articles. If no articles are delivered to the delivery tube 10 at the correct time, the machine will not operate and simply wait until the next batch is delivered. Delivery can take place as soon as the end of delivery tube has cleared the sealing device 110.

As will be seen in Figure 2, a cradle 120 is provided at each limit position in order to catch the articles when they pass out of the end of the tube into the suspended net. This prevents excessive strain being placed on the net and the use of a flexible material for the base of the cradle prevents damage to the articles. The side walls 101, 102 of the tensioning device 69 guide the articles into the cradle 120.

Figure 3 illustrates the profiled walls of sealing aperture 18 in sealing head 12 which assist in gathering and introduction of packaging material into the sealing aperture.

It will be appreciated that instead of reciprocating the delivery tube to and fro above the sealing aperture, the end of the tube may be caused to follow a closed path e.g. circular, on which the sealing aperture lies.

#### CLAIMS

1. Apparatus for packing articles into tubular packaging material, comprising a downwardly-directed delivery tube over which the packaging material can be stored and down which, in use, the articles are delivered into the already-sealed end of the packaging material; and a sealing device having a sealing aperture located below the free end of the delivery tube, said sealing device being operable to seal gathered tubular packaging material which has been introduced into the sealing aperture; characterised in that means are provided for moving at least the free end of the delivery tube whereby packaging material suspended below the end of the tube is drawn into the sealing aperture to be sealed therein.

2. Apparatus as claimed in Claim 1, wherein said sealing aperture comprises an upwardly-directed slot, and said means for moving the free end of the delivery tube are operable to oscillate the delivery tube to and fro above the aperture in substantially the same plane as said slot.

3. Apparatus as claimed in Claim 2, further

characterised in that said slot is defined at least in part by a pair of opposed sealing jaws.

4. Apparatus as claimed in any preceding claim, further characterised by control means operable to control the delivery of articles to the already-sealed end of the packaging material to coincide substantially with an end position of the delivery tube.

5. Apparatus as claimed in any preceding claim, wherein the sealing aperture is located substantially at the mid-point of travel of the delivery tube, and the apparatus is further characterised by control means operable to control the delivery of articles to the already-sealed end of the packaging material to coincide substantially with both end positions of the delivery tube.

6. Apparatus as claimed in any preceding claim, further characterised by tensioning means operable to tension the packaging material once the material has been introduced into the sealing aperture.

7. Apparatus as claimed in Claim 6, characterised in that said tensioning means comprise means for displacing said sealing device relative to and away from the free end of said delivery tube.

8. Apparatus as claimed in any of Claim 6 or Claim 7, characterised in that said tensioning means comprises a tensioning collar slidably mounted relative to said tube and being movable with the delivery tube between a retracted position at a point where the free end of the delivery tube is nearest the sealing aperture and an extended position at one or both end positions of the delivery tube where it extends beyond the end of the delivery tube and acts on the packaging material in a direction away from the sealing device thereby to tension the packaging material.

9. Apparatus as claimed in any of Claims 6 to 8, further characterised by a friction device operable frictionally to retain on the delivery tube packaging material stored thereon, and said tensioning means are operable to dispense a predetermined length of material from the delivery tube once the tension in the material reaches a given value.

10. Apparatus as claimed in any preceding claim, characterised in that said sealing device is operable to apply a pair of spaced seals to packaging material in said sealing aperture, and to sever the material between the spaced seals.

11. Apparatus as claimed in any preceding claim, characterised in that the delivery tube is pivotally mounted for reciprocal movement above said sealing aperture.

12. Apparatus for packaging articles into tubular packaging material, substantially as hereinbefore described with reference to Figure 1 or Figures 2 and 3 of the accompanying drawings.